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cedes the justice of the criticism but offers a rather lame excuse for continuing the usage. Nitrogen assimilation of Jost could easily be the synthesis of nitrogenous compounds; photosynthesis is already restricted to carbohydrate construction in which light energy is needed and by no means covers other syntheses of carbohydrates in which light is not a factor. As Jost says, there is no good reason for treating nitrogen differently from carbon, but there is no more necessity for that than for perpetuating improper terminology "with full cognizance of the difficulties involved in so doing."

To each lecture, as indicated by brackets, there have been added by Jost himself paragraph comments on later work and references to recent literature, so that the English edition is more up to date than the original and those accustomed to always using the German should remember this as well as the fact that Jost himself has made some alterations and corrections.

The typographical work conforms to the standard of the Clarendon Press though the lines are a little too close together.

While the reviewer feels that some of the matters here discussed are important he is equally earnest in saying that the translator deserves abundant credit for the valuable service he has rendered in extending the field of usefulness of such an important work.

RAYMOND H. POND.

Hilgard's Soils*

Dr. Hilgard is undoubtedly the leading authority on soils in America, having studied them critically for over fifty years, under almost every climatic condition that is found in the United States, and at all stages of economic development from primeval forests and deserts to truck-farms and gardens. The volume before us contains the essence of all his previous publications on the subject, and covers the ground very thoroughly, revealing his exten-

* Hilgard, E. W. *Soils: their formation, properties, composition, and relations to climate and plant growth in the humid and arid regions.* xxvii + 593 pp. 89 figs. New York, Macmillan Co. 1906. (On the back of the title-page is a statement that the book was published in July; but the publishers apparently did not begin to advertise it in their own periodical, *Science*, until September 28, and it was first announced in the *New York Times Saturday Review of Books* about the same time.)

sive knowledge of meteorology, physics, chemistry, geology, botany, and sociology, and their intimate relations to the main topic. At the same time it is written in a simple and attractive style, and is as free as possible from technicalities. The type, paper, and binding are well chosen, and typographical errors are few.

The main body of the book, exclusive of the very full table of contents, the preface, introduction, three appendices, and two indexes, is divided into four parts, 26 chapters, and 549 pages, including 89 figures, many of which are half-tones. It has already been reviewed appreciatively and at considerable length by a soil expert,* and the present reviewer does not feel qualified to add anything to what has been said about the first three parts, which treat of the origin, physics, and chemistry of soils. Part 4, entitled "Soils and Native Vegetation," which contains brief repetitions of some of the essential features of the three preceding parts, together with much additional matter, will interest botanists most, though the rest of the book contains many botanical references and is well worth studying.

The study of the relations between soil and vegetation has always been one of Dr. Hilgard's specialties. He points out here the difficulty of reaching correct conclusions on this subject in Europe, where most of the soils were cultivated and fertilized for generations before botany became a science, and deplores the scarcity of accurate observations in America, where the character of the original vegetation is known by tradition nearly everywhere where it does not still exist. His view, as expressed in the preface and two or three other places in the book, as well as in some earlier publications, is that "the native vegetation represents, within the climatic limits of the regional flora, the result of a secular process of adaptation of plants to climates and soils, by natural selection and the survival of the fittest. The natural floras and sylvas are thus the expression of secular, or rather millennial experience, which if rightly interpreted must convey to the cultivator of the soil the same information that otherwise he must acquire by long and costly personal experience." In this

* F. H. King in *Science* II. 24 : 681-684. 30 N 1906.

field of research Dr. Hilgard modestly credits Owen and Peter with being the pioneers in this country, but his own splendid "Report on the Geology and Agriculture of Mississippi" (printed in 1860, but unfortunately not generally distributed until several years later *) is far ahead of anything previously published in that line. It is undoubtedly the first work in which the floristic differences between the several longitudinal subdivisions of the coastal plain † are clearly pointed out, and it remains to the present day the most complete description of the vegetation (as well as of the geology) of Mississippi ever published.‡

In the new book, as in some of his previous publications, the author lays stress upon the principle that in regions of ample rainfall, like the Eastern United States, variation in the amount of lime in the soil is one of the chief causes of local diversity of vegetation; while in arid regions, where nearly all soils are calcareous, the effect of moisture is more conspicuous. This perhaps explains why most of the studies of the relations between geology and vegetation hitherto made in this country have been in the East, while ecologists living on the Plains are inclined to regard water-content of the soil as all-important.

The first chapter of part 4 is practically a condensation and revision of the author's observations in Mississippi previously published in the 1860 report just mentioned and in the fifth volume of the Tenth Census twenty-four years later. Regarding vegetation as essentially stationary, he points out the striking differences between the natural growths on calcareous and non-

* See Am. Jour. Sci. II. 32: 303. 1861; Tenth Census U. S. 5: 67, 201. 1884; Am. Geol. 27: 284-311. 1901; Bull. U. S. Geol. Surv. 283: 5, 6. 1906.

† In this connection it is noteworthy that the term "coastal plain" did not appear in strictly botanical literature until ten or twelve years ago, and even yet many American botanists do not realize its significance, and still more probably regard that province as essentially a homogeneous one.

‡ It was under his leadership that the two splendid volumes on cotton production of the southern states and California were prepared for the Tenth Census. On account of their too modest title these volumes have never received the recognition from scientists (except perhaps from geologists) that they deserve; but they are remarkable for their accuracy and completeness, and show in a most convincing manner how the local distribution of forests, crops, and population in the Southeast depends mainly on soil, rather than on temperature, latitude, altitude, or drainage basins, as some writers in the North have assumed.

calcareous, clayey and sandy, sour and neutral soils, etc. Instead of ambiguous statements that certain soils are characterized by "pines," "oaks," "bays," "gums," and the like, such as one commonly finds in soil-survey reports and other publications of similar nature, Dr. Hilgard mentions particular species, not only of trees but smaller plants, and in several cases different forms of the same species.*

A significant point which he makes (p. 495) is that the "calcifuge" plants of pine meadows have as a rule very small seeds. It would be interesting to determine how far this correlation holds with bog-plants in other parts of the world, and with plants of other habitats.

The second chapter of part 4 deals with the relations of soils to vegetation in other states of the Union and in Europe, as observed by the author and a few others who have given attention to the same problems. The statement on page 518 that "*Aster Novae-Angliae* serves as a reliable guide to high-class lands in the Middle West," when it is well known that this same handsome and easily recognizable species is a common roadside and pasture weed in the washed gravelly soils of New England, is interesting. Has this species perhaps come into New England from the West in historic times, as many other weeds have done, or are the

*It is indeed difficult (though perhaps not impossible, as some would have us believe) to draw a sharp line between variations which are due directly and solely to differences in environment, and distinct species which cannot be merged into each other. Dr. Hilgard places in the former class a few pairs of species which were not distinguished by botanists at the time he knew them in the field, but have since stood the test of cultivation side by side, and have been proved distinct by the discovery of additional characters, as well as by their respective ranges. Such pairs are *Pinus palustris* and *P. Elliottii* (p. 494), *Taxodium distichum* and *T. imbricarium* (p. 494), and probably *Quercus Phellos* and *Q. laurifolia* (pp. 502, 507). It is scarcely necessary to add that most modern species-makers are inclined to err in the other direction.

The different forms of post-oaks and black-jacks figured on pages 500 and 501 are indeed remarkable; and without having seen the originals it would be hazardous to express any opinion on them. The post-oak (*Quercus minor*) has been split up by recent writers into three or four supposed distinct species, some of which may correspond with some of Dr. Hilgard's figures; but no subspecies or varieties seem to be recorded for the black-jack (*Quercus marylandica*), which Dr. Hilgard finds equally variable. Further study of these forms in the field would be interesting.

eastern and western plants different species? Or is this a problem for the ecologist rather than for the systematist?

In discussing some of the phytogeographical phenomena of Europe Dr. Hilgard comments on the physical and chemical theories of soil influences, and the classification of plants as "calciophile," "calcifuge," "silicophile," etc., and reviews the work of Thurmann, Fliche, Grandeau, Bonnier, Contejean, A. F. W. Schimper, Wahlenberg, and others. He also emphasizes the great predominance of calcareous soils in Europe as compared with America, a fact which is often overlooked by ecologists and agricultural scientists when making use of European literature. Another important point is that the definition of calcareous soils differs considerably in the two continents. In Europe a soil is not usually called calcareous unless it effervesces with acids, which requires 4 or 5 per cent. of calcium carbonate, while in the United States many soils bearing characteristic "lime vegetation" contain less than 1 per cent. of the same mineral.

The last chapter, on the vegetation of saline and alkali lands, is based on some of the author's latest work in California. It contains illustrations of several of the characteristic alkali plants, with some anatomical and physiological notes, and statistics of the maximum, minimum, and optimum amounts of the various alkalies in the soil for each species.

The three short appendices deal with simple methods of soil examination. The subject index is as complete as could be reasonably desired, and in place of a regular bibliography there is an index of the names of authors whose works are referred to in the text.* Among about 185 such names botanists will be interested to see those of Coville, Darwin, Haberlandt, Kearney, Kuntze, Mohr, G. T. Moore, W. J. V. Osterhout, and J. W. Toumey, besides those mentioned above.

If space would permit, a great deal more might be written about this book, which must be seen to be appreciated. It will be very

* Dr. Hilgard does not attempt to list his own writings on the subject, but the following references will be instructive to the reader who wishes to become more familiar with his views: *Science* 11: 241, 242. 1888; *Overland Monthly*, D 1891; *Science* II. 18: 755-760. D 1903; 19: 233, 234. 5 F 1904; 20: 605-608. 4 N 1904; 23: 70, 71. 12 Ja 1906.

useful to all persons who are interested in the study of plant environments, especially to those who have not access to the author's Mississippi reports above mentioned ; and it should stimulate the investigation of a branch of phytogeography which has received entirely too little attention in America.

ROLAND M. HARPER.

NEWS ITEMS

According to a recent number of *Science*, Dr. M. A. Chrysler of Harvard University has accepted a position as associate professor of botany in the University of Maine.

Mr. Homer D. House has resigned the associate professorship of botany and bacteriology in Clemson College, South Carolina. He plans to spend the coming year at the New York Botanical Garden.

Dr. William L. Bray has resigned the professorship of botany in the University of Texas in order to accept the professorship of botany in Syracuse University, recently vacated by Dr. J. E. Kirkwood.

Dr. W. C. Coker, associate professor of botany in the University of North Carolina, spent a considerable part of July in studies at the New York Botanical Garden. He sailed from New York on August 3 for a visit to Porto Rico.

Professor F. S. Earle, recently director of the Cuban Agricultural Experiment Station, has been at the New York Botanical Garden for several weeks, continuing his studies of the gill-fungi. He sailed from New York for Cuba on August 10.

Dr. E. N. Transeau, who for the past year has been an investigator at the Carnegie Station for Experimental Evolution at Cold Spring Harbor, Long Island, N. Y., has accepted an appointment as professor of botany in the State Normal School at Charleston, Illinois.

Miss Winfred J. Robinson, instructor in botany in Vassar College, has a year's leave of absence, which she will devote to studies at the New York Botanical Garden. Miss Helen L. Pal-